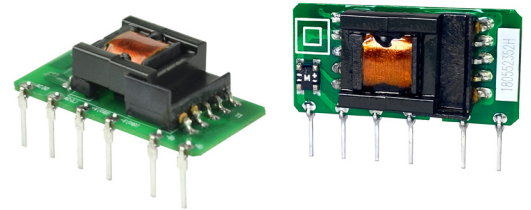


SERIES: PBO-3 | **DESCRIPTION:** AC-DC POWER SUPPLY

FEATURES

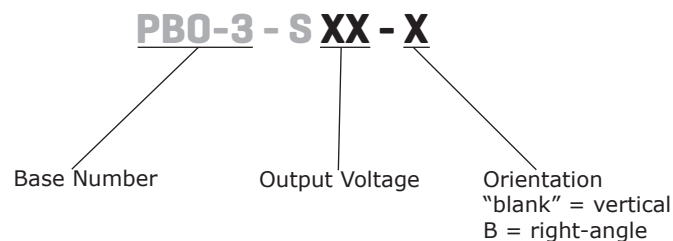
- up to 3 W continuous power
- ultra-compact SIP package
- available in straight-pin and bent-pin configurations
- wide input voltage range
- over current and short circuit protections
- 3,000 Vac isolation
- IEC, EN, UL 62368 safety approvals
- efficiency up to 77%



| MODEL | output voltage (Vdc) | output current | | output power max (W) | ripple and noise ¹ max (mVp-p) | efficiency ² typ (%) |
|---------------------------|-------------------------|----------------|-------------|----------------------------|---|---------------------------------------|
| | | min (mA) | max (mA) | | | |
| PBO-3-S3.3 ^{4,5} | 3.3 | 60 | 600 | 1.98 | 150 | 65 |
| PBO-3-S5 ^{4,5} | 5 | 60 | 600 | 3 | 150 | 70 |
| PBO-3-S9 ⁴ | 9 | 33.3 | 333 | 3 | 150 | 73 |
| PBO-3-S12 ^{4,5} | 12 | 25 | 250 | 3 | 150 | 74 |
| PBO-3-S15 ⁵ | 15 | 20 | 200 | 3 | 150 | 75 |
| PBO-3-S24 ^{4,5} | 24 | 12.5 | 125 | 3 | 150 | 77 |

- Notes:
1. At full load, nominal input, 20 MHz bandwidth oscilloscope, with a 1 µF ceramic and 10 µF electrolytic capacitor on the output.
 2. At 230 Vac input.
 3. All specifications are measured at T_a=25°C, humidity <75%, 115 or 230 Vac input voltage, and rated output load unless otherwise specified.
 4. Discontinued model - vertical pin version.
 5. Discontinued model - right-angle pin version.

PART NUMBER KEY



INPUT

| parameter | conditions/description | min | typ | max | units |
|---------------------------|------------------------|-----|-----|------|-------|
| voltage | | 85 | | 305 | Vac |
| | | 70 | | 430 | Vdc |
| frequency | | 47 | | 63 | Hz |
| current | at 115 Vac | | | 0.12 | A |
| | at 277 Vac | | | 0.06 | A |
| inrush current | at 115 Vac | | 13 | | A |
| | at 277 Vac | | 23 | | A |
| no load power consumption | at 230 Vac | | | 0.25 | W |

OUTPUT

| parameter | conditions/description | min | typ | max | units |
|----------------------------|---|-----|--------------|-----|--------|
| capacitive load | 3.3 Vdc output models | | | 820 | μF |
| | 5 Vdc output models | | | 680 | μF |
| | 9/12 Vdc output models | | | 470 | μF |
| | 15 Vdc output models | | | 330 | μF |
| | 24 Vdc output models | | | 100 | μF |
| initial set point accuracy | 3.3 Vdc output models | | | ±6 | % |
| | all other models | | | ±5 | % |
| line regulation | at full load | | | | |
| | 3.3 Vdc output models all other models | | ±2.5 ±1.5 | | % % |
| load regulation | from 10~100% load | | | | |
| | 24 Vdc output models all other models | | ±6 ±3 | | % % |
| switching frequency | | | | 65 | kHz |
| temperature coefficient | | | ±0.15 | | %/°C |

PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|--------------------------|---------------------------|-----|-----|-----|-------|
| over current protection | auto recovery | 110 | | 500 | % |
| short circuit protection | continuous, auto recovery | | | | |

SAFETY & COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|---------------------|---|-------|-----|-----|-------|
| isolation voltage | input to output for 1 minute | 3,000 | | | Vac |
| safety approvals | certified to 62368: IEC, EN, UL | | | | |
| safety class | class II | | | | |
| conducted emissions | CISPR22/EN55022 Class A, (recommended circuit 1,2,6) | | | | |
| | CISPR22/EN55022 Class B, (recommended circuit 3,4,5) | | | | |
| radiated emissions | CISPR22/EN55022 Class A, (recommended circuit 1,2,6) | | | | |
| | CISPR22/EN55022 Class B, (recommended circuit 3,4,5) | | | | |
| ESD | IEC/EN61000-4-2, contact ±4 kV, perf. Criteria B | | | | |
| radiated immunity | IEC/EN61000-4-3, 10V/m, perf. Criteria A | | | | |
| EFT/burst | IEC/EN61000-4-4, ±2 kV (recommended circuit 1,2,3), perf. Criteria B | | | | |
| | IEC/EN61000-4-4, ±4 kV (recommended circuit 4,5,6), perf. Criteria B | | | | |
| surge | IEC/EN61000-4-5, line to line ±1 kV (recommended circuit 1,2), perf. Criteria B | | | | |
| | IEC/EN61000-4-5, line to line ±2 kV (recommended circuit 6), perf. Criteria B | | | | |
| | IEC/EN61000-4-5, line to line ±1 kV/line to ground ±2 kV (recommended circuit 3) perf. Criteria B | | | | |
| | IEC/EN61000-4-5, line to line ±2 kV/line to ground ±4 kV (recommended circuit 4,5) perf. Criteria B | | | | |
| conducted immunity | IEC/EN61000-4-6 Class A, 10 Vr.m.s, perf. Criteria A | | | | |

SAFETY & COMPLIANCE (CONTINUED)

| parameter | conditions/description | min | typ | max | units |
|------------------------------|--|---------|-----|-----|-------|
| voltage dips & interruptions | IEC/EN61000-4-11, 0%-70%, perf. Criteria B | | | | |
| MTBF | as per MIL-HDBK-217F at 25 °C | 300,000 | | | hours |
| RoHS | 2011/65/EU | | | | |

Notes: 1. The power supply is considered a component which will be installed into final equipment. The final equipment still must be tested to meet the necessary EMC directives.

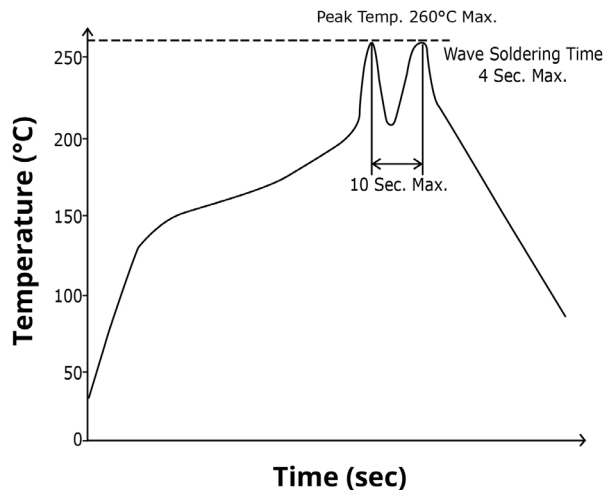
ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves | -40 | | 85 | °C |
| storage temperature | | -40 | | 105 | °C |
| storage humidity | non-condensing | | | 85 | % |

SOLDERABILITY

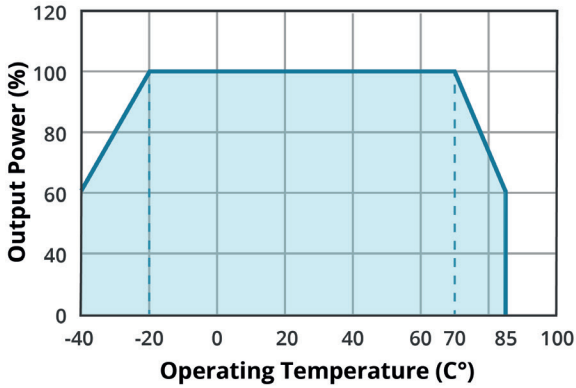
| parameter | conditions/description | min | typ | max | units |
|----------------|------------------------|-----|-----|-----|-------|
| hand soldering | for 3~5 seconds | 350 | 360 | 370 | °C |
| wave soldering | for 5~10 seconds | 255 | 260 | 265 | °C |

WAVE SOLDERING PROFILE

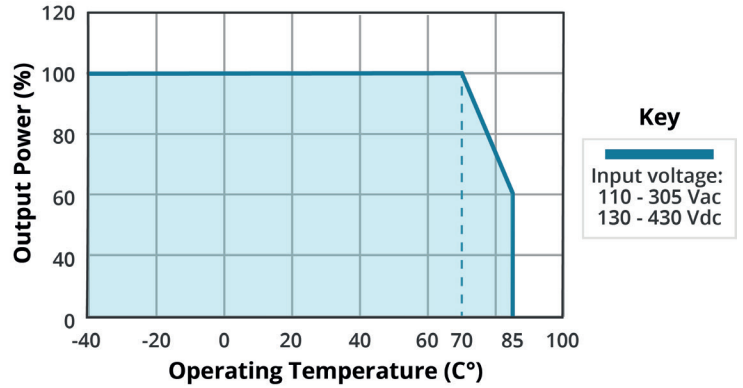


DERATING CURVES

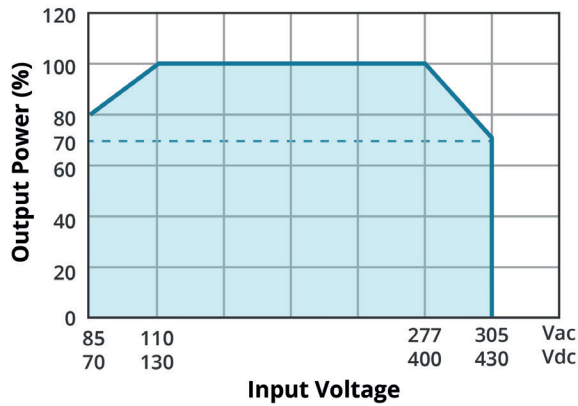
TEMPERATURE DERATING CURVE



TEMPERATURE DERATING CURVE

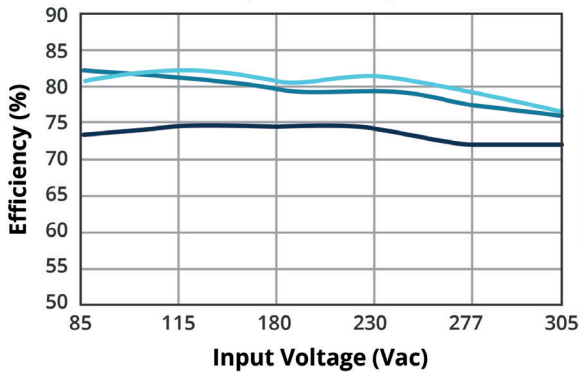


INPUT VOLTAGE DERATING CURVE (25°C)

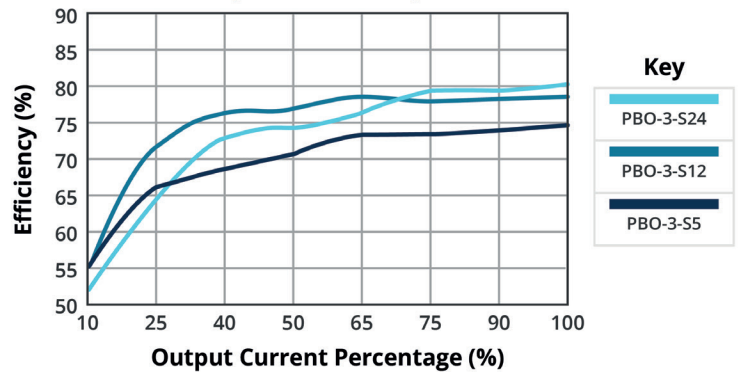


EFFICIENCY CURVES

EFFICIENCY VS INPUT VOLTAGE (FULL LOAD)



EFFICIENCY VS OUTPUT LOAD (VIN = 230 VAC)



MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|------------|---|-----|-----|-----|----------|
| dimensions | vertical models: 35.00 x 11.00 x 18.00 (1.38 x 0.43 x 0.71 inches) right-angle models: 35.00 x 18.00 x 11.00 (1.38 x 0.71 x 0.43 inches) | | | | mm mm |
| weight | | | 6 | | g |

MECHANICAL DRAWING

Vertical Orientation

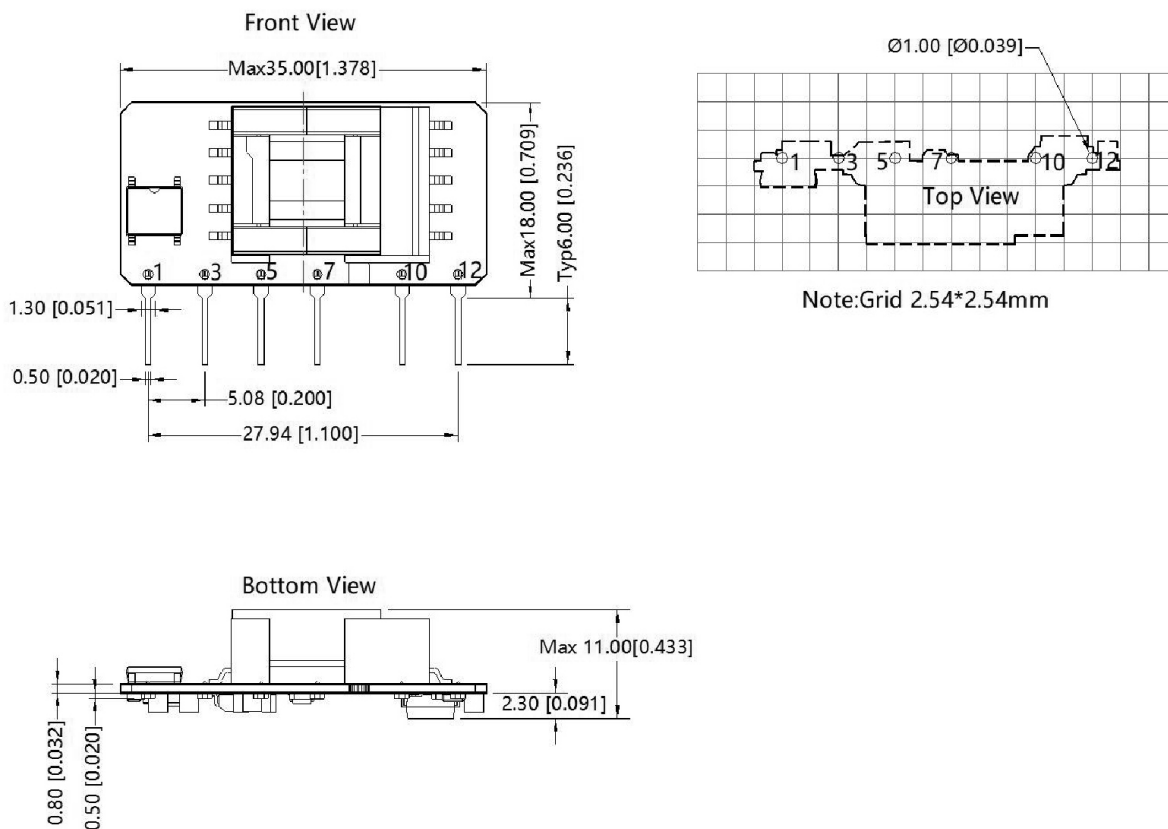
units: mm[inch]

pin section tolerance: $\pm 0.10[\pm 0.004]$

tolerance: $\pm 0.50[\pm 0.020]$

| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | Function |
| 1 | AC (N) |
| 3 | AC (L) |
| 5 | +V(CAP) |
| 7 | -V(CAP) |
| 10 | -Vo |
| 12 | +Vo |

Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).



MECHANICAL DRAWING (CONTINUED)

Right-angle Orientation

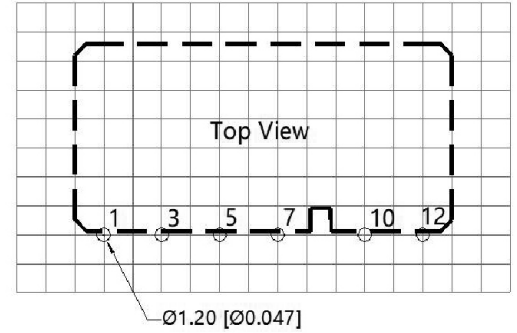
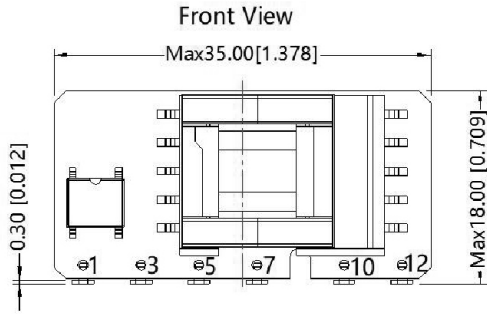
units: mm[inch]

pin section tolerance: $\pm 0.10[\pm 0.004]$

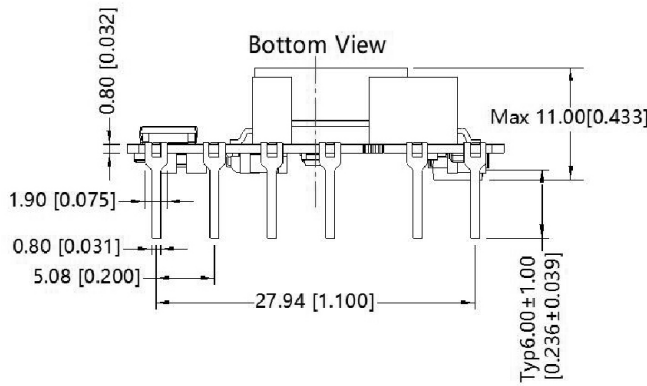
tolerance: $\pm 0.50[\pm 0.020]$

| PIN CONNECTIONS | |
|-----------------|----------|
| PIN | Function |
| 1 | AC (N) |
| 3 | AC (L) |
| 5 | +V(CAP) |
| 7 | -V(CAP) |
| 10 | -Vo |
| 12 | +Vo |

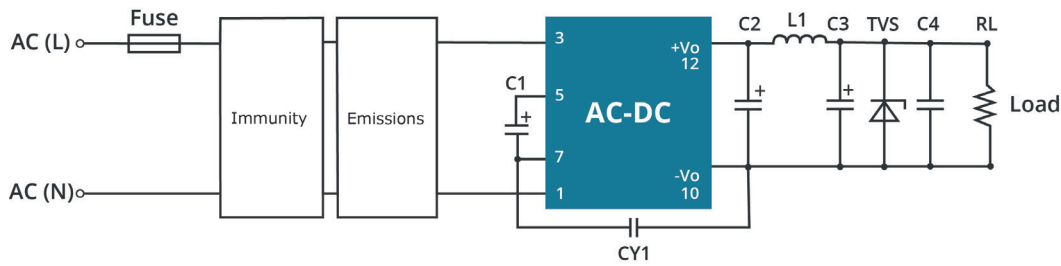
Note: 1. It is required to add C1 between pins 5 & 7 (see application circuits).



Note: Grid 2.54*2.54mm



APPLICATION DESIGN REFERENCE



| PBO-3 series additional circuits design reference | | | |
|---|----------|---|---------|
| Immunity design circuits for reference | | Emissions design circuits for reference | |
| Class III | Class IV | Class A | Class B |
| | | | |

| PBO-3 Series additional component selection guide | | | | | | | |
|---|-----------------|--|-----------------------------------|------------------|---------------|-----------|----------------|
| Part no. | FUSE (required) | C1 (required) | C2 (required) | L1 (required) | C3 (required) | C4 | CY1 (required) |
| PBO-3-S3.3 | 1A/300V | 10μF/450V (-20°C~85°C) 22μF/450V (-40°C~85°C) | 270μF/16V (solid-state capacitor) | 4.7μH (max 60mΩ) | 120μF/25V | 0.1μF/50V | 1.0nF/400 Vac |
| PBO-3-S5 | | | | | 68μF/35V | | |
| PBO-3-S9 | | | | | 47μF/35V | | |
| PBO-3-S12 | | | | | | | |
| PBO-3-S15 | | | | | | | |
| PBO-3-S24 | 220μF/35V | | | | | | |

Note: 1. C1: Input capacitors, C2: output storage capacitors, must be connected externally.
 2. It is recommended using an electrolytic capacitor with high frequency and low ESR rating for C3. Combined with C2, L1, they form a pi-type filter circuit. Choose a capacitor voltage rating with at least 20% margin, in other words not exceeding 80%. C4 is a ceramic capacitor, used for filtering high frequency noise. A suppressor diode (TVS) is a recommended to protect the application in case of a converter failure and specification should be 1.2 times of the output voltage.

| PBO-3 Series Environmental and EMC selection guide | | | | | | |
|--|-------------------------------|---|---------------------|-------------------------|-----------|-----------|
| Recommended circuit | Application environmental | Typical industry | Input voltage range | Environment temperature | Emissions | Immunity |
| 1/2 | Basic application | None | 85 ~ 305 Vac | -40° ~ 88°C | Class A | Class III |
| 3 | Indoor civil environment | Smart home / Home appliances (2Y) | | -25° ~ 55°C | Class B | Class III |
| | Indoor general environment | Intelligent building / Intelligent agriculture | | -25° ~ 55°C | Class B | Class IV |
| 4/5 | Indoor industrial environment | Manufacturing workshop | | -25° ~ 55°C | Class B | Class IV |
| 6 | Outdoor general environment | ITS / Video monitoring / Charging point / Communication / Security and protection | | -40° ~ 85°C | Class A | Class IV |

EMC RECOMMENDED CIRCUIT

Circuit 1

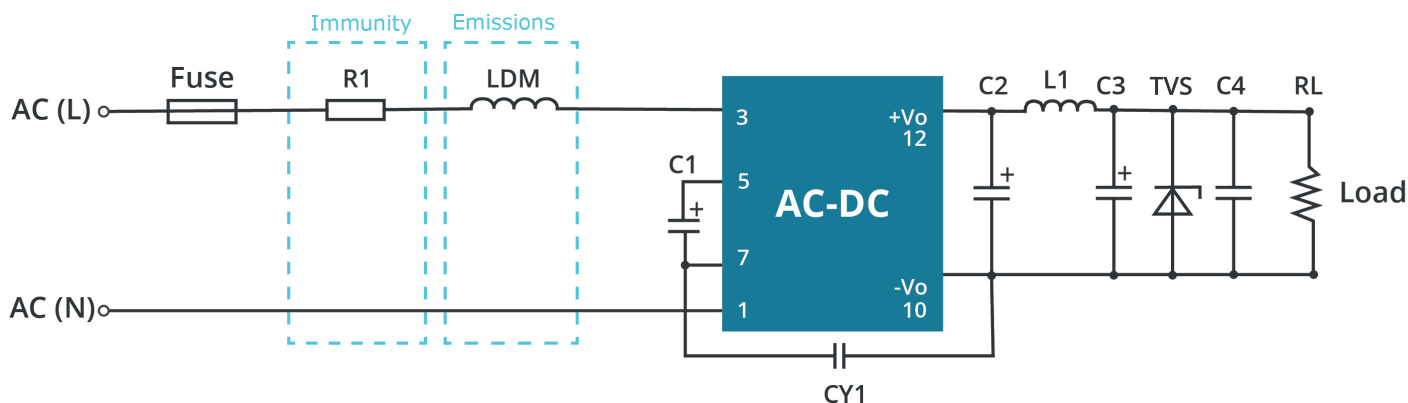


Table 1

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|--------------------------|---------------------------|----------------|-----------------|
| Basic application | -40°C ~ 85°C | Class III | Class A |

| Component | Recommended value |
|-----------------|--------------------|
| R1 | 12Ω/3W |
| LDM | 4.7mH |
| FUSE (required) | 1A/300V, slow-blow |

Circuit 2

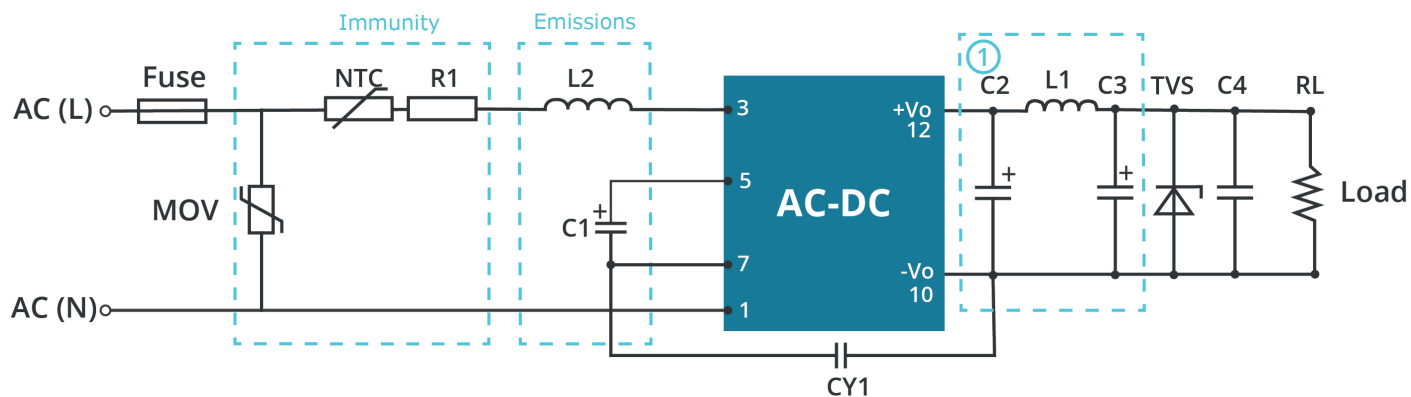


Table 2

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|--------------------------|---------------------------|----------------|-----------------|
| Basi application | -40°C ~ 85°C | Class III | Class A |

| Component | Recommended value |
|-----------------|--------------------|
| R1 | 12Ω/2W |
| L2 | 4.7mH |
| NTC | 13D-5 |
| MOV | S14K350 |
| FUSE (required) | 1A/300V, slow-blow |

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 3

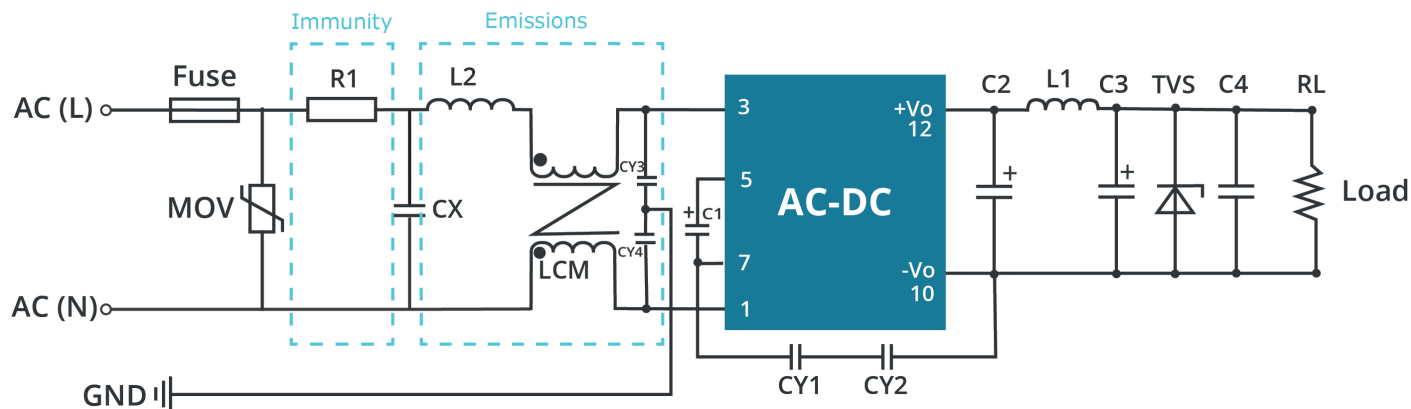


Table 3

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|--------------------------|---------------------------|----------------|-----------------|
| Indoor civil / general | -40°C ~ 55°C | Class III | Class B |

| Component | Recommended value |
|-----------------|--------------------|
| R1 | 12Ω/3W |
| CY1 (CY2) | 1.0nF/400Vac |
| LCM | 3.5mH |
| LDM | 0.33mH |
| CX | 0.1μF/310Vac |
| CY3, CY4 | 0.56nF/400Vac |
| FUSE (required) | 1A/300V, slow-blow |

Note: In the home appliance application environment, the two Y capacitors of the primary and secondary need to be externally connected (CY1/CY2, value at 2.2nF/400Vac) which can meet the EN60335 certification. In other industries, only one Y capacitor is required.

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 4

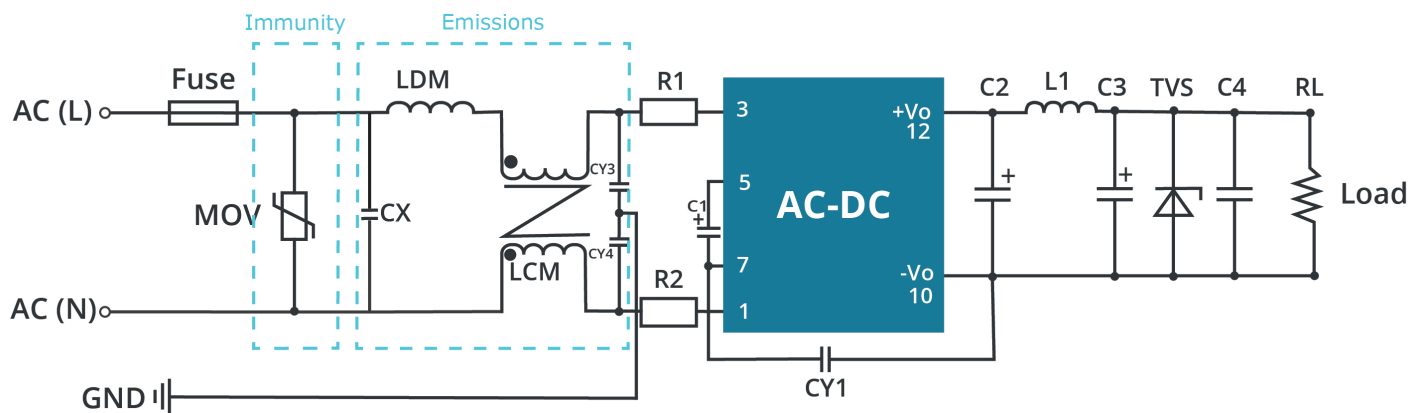


Table 4

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|--------------------------|---------------------------|----------------|-----------------|
| Indoor industrial | -25°C ~ 55°C | Class IV | Class B |

| Component | Recommended value |
|-----------------|--------------------|
| MOV | S14K350 |
| C1 | 450V/22uF |
| CY1 | 2.2nF/400Vac |
| CX | 0.1µF/310Vac |
| LCM | 3.5mH |
| LDM | 0.33mH |
| R1, R2 | 12Ω/2W |
| CY3, CY4 | 0.56nF/400Vac |
| FUSE (required) | 2A/300V, slow-blow |

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 5

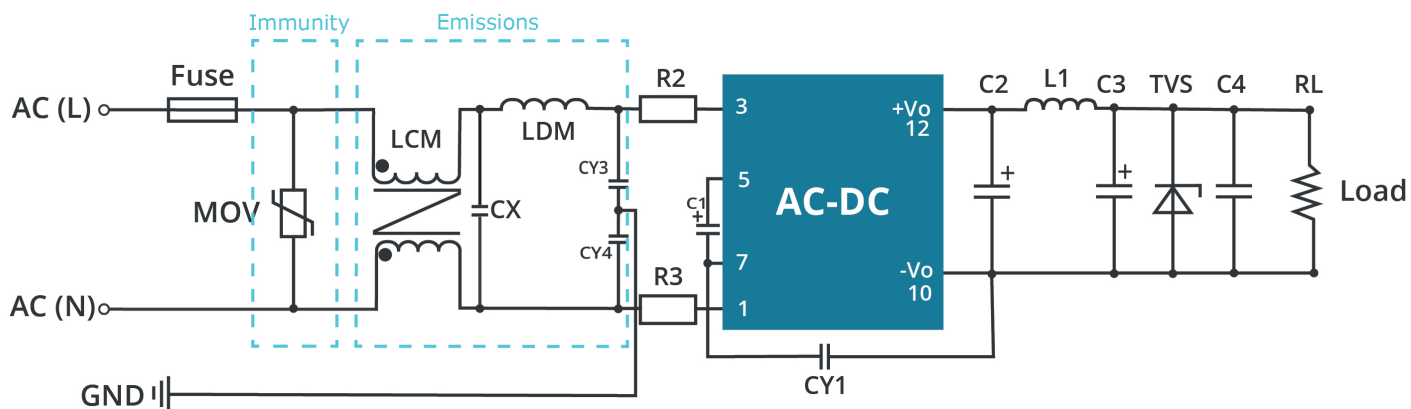


Table 5

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|--------------------------|---------------------------|----------------|-----------------|
| Indoor industrial | -25°C ~ 55°C | Class IV | Class B |

| Component | Recommended value |
|-----------------|--------------------|
| MOV | S14K350 |
| C1 | 450V/22uF |
| CY1 | 2.2nF/400Vac |
| CY3/CY4 | 0.56µF/400Vac |
| CX | 0.1µF/310Vac |
| LCM | 3.5mH |
| LDM | 0.33mH |
| R2/R3 | 12Ω/2W |
| FUSE (required) | 2A/300V, slow-blow |

EMC RECOMMENDED CIRCUIT (CONTINUED)

Circuit 6

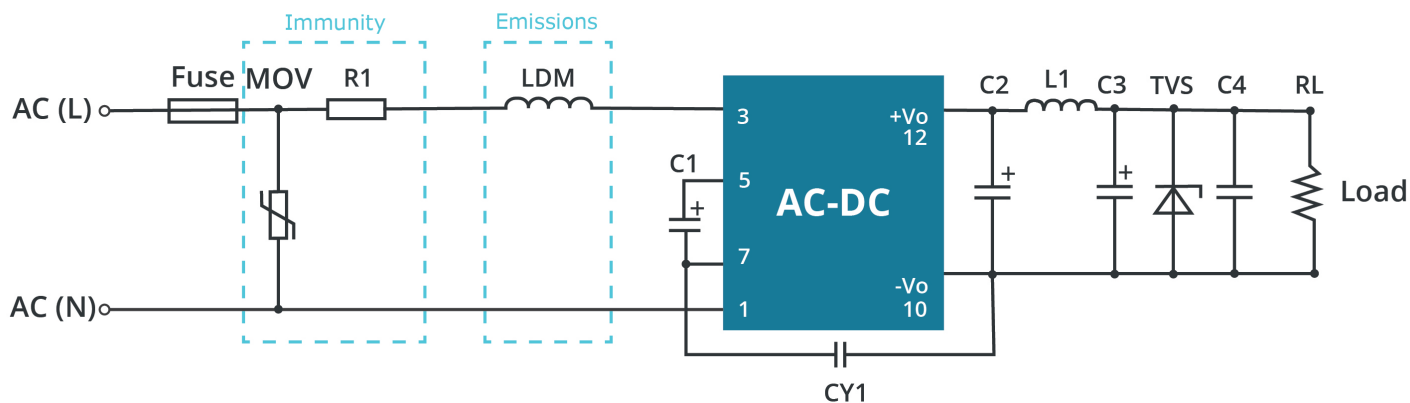


Table 6

| Application enviromental | Ambient temperature range | Immunity Class | Emissions Class |
|----------------------------|---------------------------|----------------|-----------------|
| Outdoor general enviroment | -40°C ~ 85°C | Class IV | Class A |

| Component | Recommended value |
|-----------------|--------------------|
| MOV | S14K350 |
| C1 | 450V/22uF |
| LDM | 4.7mH |
| R1 | 12Ω/3W |
| FUSE (required) | 2A/300V, slow-blow |

REVISION HISTORY

| rev. | description | date |
|------|--|------------|
| 1.0 | initial release | 10/18/2016 |
| 1.01 | internal IC changed | 05/11/2017 |
| 1.02 | updated efficiency curves | 02/05/2018 |
| 1.03 | datasheet update, safety approvals updated to match 62368 certification, PCN-656-95022R-01 | 10/12/2020 |
| 1.04 | product image updated | 09/16/2021 |
| 1.05 | derating curves updated | 01/18/2022 |
| 1.06 | product image updated | 03/10/2022 |
| 1.07 | UKCA mark added | 05/25/2022 |
| 1.08 | discontinued models PBO-3-S3.3, PBO-3-S3.3-B, PBO-3-S5, PBO-3-S5-B, PBO-3-S9, PBO-3-S12, PBO-3-S12-B, PBO-3-S15, PBO-3-S15-B, PBO-3-S24, PBO-3-S24-B | 09/13/2022 |

The revision history provided is for informational purposes only and is believed to be accurate.



CUI INC
a bel group

Headquarters
20050 SW 112th Ave.
Tualatin, OR 97062
800.275.4899

Fax 503.612.2383
cui.com
techsupport@cui.com

CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

CUI reserves the right to make changes to the product at any time without notice. Information provided by CUI is believed to be accurate and reliable. However, no responsibility is assumed by CUI for its use, nor for any infringements of patents or other rights of third parties which may result from its use.

CUI products are not authorized or warranted for use as critical components in equipment that requires an extremely high level of reliability. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.